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DOUBLE-DRUM DEJUICING PRESS

R. P. Graham, A. H. Brown, and W. D. Ramage
Western Regional Research Laboratory, Albany, California

Principles, features of construction, and performance of the double-drum dejuicing press, a new machine developed for separating juice from pear waste, are described by text, diagrams, and photographs in this publication.

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CONTENTS:

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The double-drum dejuicing press was developed by the Western Regional Research Laboratory as part of a project on the utilization of pear cannery waste, undertaken in cooperation with the Canners League of California. The press development was undertaken only after commercial continuous presses had proved to be unsuitable for handling pear waste, and was carried forward only to the extent required by the pear waste project. The dejuicing press as described herein and in other publications (see appended references) is not considered to be a finished development; future models of the press should incorporate at least the mechanical improvements suggested in a later section of this report. To date, the press has been used on pear waste under conditions approximating commercial operation and has shown every indication of being suitable for its intended function.

Background

Particular properties of pear waste govern the type of equipment required for separation of juice from solids. When pear cannery waste is ground, the resulting product is a soft, pulpy, viscous puree. Proper treatment of the ground waste with lime and heat alters the pectin so that the viscosity of the waste is reduced, and releases a considerable amount of juice. The solids in the treated waste are, however, soft and pulpy, and contain very little true fiber.

Substantial amounts of juice can be pressed from treated waste if the material is well supported on a filter surface and if pressure is applied slowly so that the dejuiced portions of the waste form a porous filter mat during the dejuicing process. Rapid application of pressure causes an initial flow of puree or cloudy juice, followed by rapid blinding of the filter surface and cessation of juice flow.

When treated pear waste is adequately dejuiced under proper conditions, the filter cake is easily removed from the filter surface. The cake is porous and easily dried. If, however, the cake is disturbed or smeared during dejuicing, further dejuicing is difficult. Further moderate pressing yields a limited amount of cloudy juice; increased pressure causes extrusion of puree. The cake loses its porosity and becomes difficult to dry.

With properly pretreated pear waste, about 50 percent of the juice can be removed by slow initial dejuicing at low pressures or under partial vacuum filtration conditions. An overall juice recovery of 75 to 80 percent can be obtained if the undisturbed, partially dejuiced cake is pressed at 20 to 30 p.s.i. The final cake can be shredded and dried without difficulty in a rotary drier. However, treated waste can be dejuiced to the extent indicated in reasonably short times only when relatively thin layers of filter cake are used.

To apply the principles outlined in the foregoing paragraphs, a machine was developed which continuously establishes two relatively thin filter cakes under low pressure, brings the cakes together, and presses them under a pressure of 5 to 10 times that used during the filtration portion of the cycle. The position of the cake is not disturbed from the beginning of the filtration operation to the end of the pressing operation. The gentle initial filtering action followed by pressing of the undisturbed filter cake produces a much clearer juice than is obtained from usual types of presses.

Press Construction

The double-drum dejuicing press consists primarily of two driven drums partially covered by a pressurized dome which is attached to the drums through seals that permit free rotation of the drums. The drums are mounted horizontally and parallel, and turn together and downward at the line of contact during operation. The axis of one drum is fixed, the other moves horizontally away from the fixed drum against restraint imposed by rubber buffers. As the drums rotate, cake is discharged from between them and drops into a conveyor. A string discharge assists in removing the cake from the drums.

The double-drum dejuicing press shown in the attached photographs has drums which are 4 feet in diameter and 4 feet in length. The basic arrangement of the drums, dome, bearing and frame are shown in Fig. 1 of the attached sketches. The upper photograph shows the drums, completely assembled and mounted in position on the press frame, ready for installation of the dome. Details of the drum driving system are also shown in the upper photograph. The lower photograph shows the press completely assembled, ready for operation. The cake conveyor extends outward to the left; the juice pump is shown at the lower right.

Constructional details of a filter drum are shown in Fig. 2. The surface of the drum is covered with a suitable type of filter cloth (ordinarily a comparatively open weave) laid over a wire supporting screen. The wire screen in turn lies over a perforated steel sheet which is the outer member of the drum. The outer portion of the drum is of annular construction, divided into compartments parallel to the axis of the drum, to control the flow of juice as the drum rotates. Each juice compartment is provided with drain holes. In operation, juice passes through the filter cloth and into the compartments. Most of the juice flows through the compartment drains into the interior of the drums, and outward through holes in the ends of the drums. A portion of the juice flows back through the cloth to serve as a backwash after the press cake has been removed.

The types of seals used between the dome and the drums are shown in the sketches. Two types of side seals have been used. The pressure seal shown in Fig. 3a (used during the 1950 pear canning season) was discarded because of difficulties encountered when the steel seal ring on the drum wore grooves in the neoprene belting member of the outer portion of the seal. A tongue-and-groove type of side seal, shown in Fig. 3b, was used in 1951 and performed satisfactorily. The multiple flap type of seal shown in Fig. 3c was used on the drum faces during both seasons, and proved to be fully satisfactory.

In operation, the material to be dejuiced is pumped into each end of the dome. A suitable pressure may be maintained by the feed pump, or by standpipes located at each end of the dome. In any case, the material should be supplied at an even, rather than a pulsating, pressure. For treated pear waste, a pressure of 5 p.s.i. at the dome is ample for effective operation. The final pressure on the cake at the pinch point of the drums is controlled by two rubber buffers acting on the movable bearings of one of the drums. The mechanical details of the buffer are shown in Fig. 4. For pear waste, the buffers were adjusted to provide a load between drums of about 75 pounds per inch of drum width. The drums were turned at 1 revolution in 3 to 5 minutes during operation on pear waste.